

TRANSPARENT CONDUCTIVE FILM

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a transparent conductive film capable of showing excellent display quality when used for a display or the like and good handling properties in the course of manufacturing, processing or the like. The present invention also relates to a touch panel and an electroluminescent display panel that use such a transparent conductive film. Furthermore, the present invention relates to a process of producing the transparent conductive film.

[0003] 2. Description of Related Art

[0004] Transparent conductive films function as electrodes, and, in addition, have transparency, so that it is possible to see objects through these films. They are, therefore, often used as electrode sheets for display panels of various modes or touch panels to be placed on the surfaces of displays.

[0005] For example, such a transparent conductive film is obtained by laminating a transparent conductive layer of ITO (indium tin oxide), ATO (antimony-doped indium tin oxide) or the like to the surface of a transparent plastic film such as a polyethylene terephthalate resin film.

[0006] In the case where the above-described transparent conductive film is used for a display panel or touch panel, it has sometimes been subjected to anti-glaring treatment, in which a mat paint is applied to the transparent conductive film for the purpose of decreasing reflection of extraneous light. If a mat paint is applied to the transparent conductive film, the effect of preventing glaring can be obtained, but the following problems newly occur: an image on the display visible through the transparent conductive film appears fuzzy; the moiré pattern appears at boundaries between pixels on the display; and the central part of the display is strikingly seen due to its brightness higher than that of the other part.

[0007] Attaching great importance to transparency, on the other hand, there has also been adopted, to improve display visibility, such a means that the surface of the transparent conductive film is smoothed to a mirror surface to eliminate the scattering of light. However, a transparent conductive film having a mirror surface is extremely poor in surface slipperiness. Therefore, when such a transparent conductive film is processed by a roll-to-roll method (a method comprising: unwinding a continuous substrate such as a transparent plastic film; forming a transparent conductive layer on the substrate under vacuum by deposition, sputtering or the like; and winding, around a roll, the transparent conductive film obtained), such a phenomenon (blocking) tends to occur that one surface of the substrate sticks to the other surface of the substrate or that the substrate cannot smoothly run in the production unit. If blocking occurs, the transparent conductive film obtained cannot be rolled into a good shape, and the unrolled transparent conductive film has traces of blocking on its surface.

[0008] To prevent occurrence of blocking, it seems effective to employ such a technique that a blocking-preventing tape is adhered to or irregularities called knurls are provided

on both sides of the transparent plastic film. To employ this technique, however, it is necessary to modify those sections of the production unit that correspond to a series of the steps of forming a transparent conductive layer by vacuum deposition or sputtering on an unwound substrate film, and winding the transparent conductive film obtained. In addition, after these steps, it is necessary to remove the tape adhered to both sides of the substrate film, or to remove both sides of the substrate film, on which the irregularities are provided, by a slitter or the like.

SUMMARY OF THE INVENTION

[0009] The present invention was accomplished in the light of the aforementioned drawbacks in the related art. An object of the present invention is to provide a transparent conductive film capable of showing excellent display quality when used for a display or the like and good handling properties in the manufacturing process or the like; a touch panel and an electroluminescent display panel that use such a transparent conductive film; and a process of producing the transparent conductive film.

[0010] A first aspect of the present invention is a transparent conductive film comprising: a transparent plastic film; and a transparent conductive layer laminated to one surface of the transparent plastic film; wherein the transparent conductive film, as a whole, has a haze value of 8 or less; and at least one of the two surfaces of the transparent plastic film, that is, the surface to which the transparent conductive layer is laminated and the other surface, is provided with fine irregularities having a maximum height (Rmax) of 0.5 to 2.0 μm .

[0011] In the first aspect of the present invention, it is preferable that the fine irregularities have a ten-point mean roughness (Rz) of 0.35 to 1.5 μm .

[0012] Further, in the above-described first aspect, the fine irregularities may be provided as the surface structure of the transparent plastic film or that of a transparent resin layer laminated to the surface of the transparent plastic film.

[0013] Furthermore, in the first aspect described above, it is preferable that the transparent conductive film further comprises a hard coat layer laminated to the surface of the transparent plastic film opposite to the surface to which the transparent conductive layer is laminated. In this case, it is preferable that the fine irregularities be provided on the surface of the transparent plastic film to which the transparent conductive layer is laminated; and that the other surface of the transparent plastic film to which the hard coat layer is laminated be made smooth so that the exposed surface of the hard coat layer can be a mirror surface.

[0014] A second aspect of the present invention is a touch panel comprising: a first sheet having an electrode layer; and a second sheet having an electrode layer, arranged on the first sheet with a spacer interposed between the first and second sheets so that the two electrode layers can face each other with an extremely small gap between them; wherein at least one of the first and second sheets is a transparent conductive film that comprises a transparent plastic film and a transparent conductive layer serving as the electrode layer, laminated to one surface of the transparent plastic film, the transparent conductive film, as a whole, having a haze value of 8 or less, at least one of the two surfaces of the transparent